



OUTBREAK SPOTLIGHT....

“**Outbreak Spotlight**” is a regularly appearing feature in the *Indiana Epidemiology Newsletter* to illustrate the importance of various aspects of outbreak investigation. The event described below highlights how using an epidemic curve can be used to determine the most likely exposure from several possibilities.

The Jail House Rocked

Outbreak of *Clostridium perfringens* at a Correctional Facility

Background

On April 22, 2002, a concerned citizen notified the Indiana State Department of Health (ISDH) that several inmates at the County A Jail had developed symptoms of gastroenteritis, characterized primarily by vomiting and diarrhea, after eating dinner on April 18. Approximately 280 inmates are housed at the facility. All meals are prepared in a central kitchen, served on individual trays, then transported to three facilities within the jail complex.

Epidemiologic Investigation

The ISDH and the County A Health Department (CAHD) initiated a collaborative investigation of this outbreak. A case-control study was conducted in order to describe the outbreak and to determine whether the source may have been food-related. CAHD obtained a menu of all food items served at the jail during breakfast, lunch and dinner on April 17 and 18, and the ISDH developed a questionnaire which documented illness history and foods eaten on the days in question. CAHD distributed the questionnaire to inmates at the jail. Completed questionnaires were returned to CAHD and forwarded to the ISDH Epidemiology Resource Center for analysis. A case was defined as any previously healthy person at the jail who became ill with diarrhea and/or vomiting on or after April 18. Any person at the jail who was well before and after April 18 was eligible to be included as a control. Any person who was ill for any reason in the week before April 18 or who became ill with symptoms that did not include diarrhea and/or vomiting was excluded from the study.

Twenty-nine inmates who reported becoming ill completed questionnaires. Twenty-six met the case definition. Eighteen inmates were identified as controls. Symptoms reported by the 26 cases included: diarrhea (100%), abdominal cramps (92%), body aches (65%) and nausea (58%). Other symptoms reported included vomiting, headache, and chills. The median duration of illness was 29.25 hours (range: 8.0 hours to 76.0 hours). At least four cases sought medical attention, but no one was hospitalized overnight. Eight cases submitted stool specimens, two of which met the laboratory criteria for *Clostridium perfringens* intoxication (see “Laboratory Results”). Illness was mainly confined to one unit of the jail.

Exposure may have occurred during one of several meals. According to the epidemic curve (see figure 1), the peak of onset times occurred at 3:00 a.m. on Friday, April 19. The incubation period for *Clostridium perfringens* intoxication is 6-24 hours, averaging 10-12 hours. The most likely exposure period can be determined by counting back the average incubation period, 10-12 hours, from 3:00 a.m. on April 19, which is approximately 3:00-5:00 p.m. on Thursday, April 18. Alternately, the most likely exposure period can be determined by counting back the minimum incubation period, 6 hours, from the onset time of the first case, 11:00 p.m. on April 18. This is approximately 5:00 p.m. on Thursday, April 18. According to CAHD, dinner was served about 4:45-5:30 p.m. that day. Thus, the most likely exposure period occurred during dinner on April 18. Based on this information, the median incubation period of illness was 11.0 hours (range: 2.0 hours to 27.0 hours).

Statistical analysis of the food items served during dinner on April 18 revealed that chicken a la king was most likely associated with illness (odds ratio = undetermined, p-value = 0.06). Although the p-value exceeds the statistical cutoff of 0.05, the value does approach the statistical cutoff.

Environmental Assessment

A representative from CAHD visited the jail on April 19 to review food preparation practices and collect any available food samples. Two critical violations were noted. First, the 2-door cooler next to the preparation line measured 50°F. According to Indiana Food Code, refrigeration temperature must be 41°F or below. This violation was to be corrected by April 26. Second, consumed food was discarded in batter/flour, and a box was stacked on open nacho chips. Eating must only be done in approved areas, and boxes are not to be stacked on open food items. These two violations were corrected on site by discarding the batter and nacho chips. Several food samples were collected for laboratory analysis (see “Laboratory Results”).

Laboratory Results

Eight cases submitted stool specimens to the ISDH Laboratories for analysis. Four specimens were collected as bulk stool with no preservation and were unsatisfactory for analysis. Four specimens tested negative for *Campylobacter*, *E. coli* O157:H7, *Salmonella* and *Shigella*. *Clostridium perfringens* was detected in the four specimens as follows:

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|--------------|-------------------------------|-----------------------|
| • Specimen 1 | 4 x 10 ⁵ CFU*/gram | *colony forming units |
| • Specimen 2 | 1 x 10 ⁶ CFU/gram | |
| • Specimen 3 | 2 x 10 ⁴ CFU/gram | |
| • Specimen 4 | 1 x 10 ⁶ CFU/gram | |

Cases are confirmed by demonstration of *Clostridium perfringens* in stool cultures yielding at least 1 x 10⁶ CFU/gram¹.

Several food samples were available for laboratory analysis. CAHD collected chili, fruit, and bread with margarine from lunch served on April 18. Chicken a la king, mashed potatoes, dessert, and bread were collected from dinner served on April 18. The chicken a la king had an elevated aerobic plate count (APC), which is the level of bacteria found in a food item. This does not include *Clostridium perfringens*. All other samples tested within normal bacterial standards.

Conclusions

This investigation confirms that an outbreak of gastroenteritis occurred following dinner at the County A Jail on April 18. The extremely short window of illness onset and lack of subsequent cases after the outbreak strongly suggests a common source exposure.

The causative agent of this outbreak was *Clostridium perfringens*. Two stool specimens were confirmed positive by laboratory testing. The symptoms experienced (diarrhea and cramping) are typical of illness caused by *C. perfringens*. Vomiting and fever are usually absent, as was reported in this outbreak. The duration of symptoms (median: 29.25 hours) and incubation period (median: 11.0 hours) are also typical of clostridial foodborne intoxication. *C. perfringens* gastroenteritis generally has an incubation period of 6 to 24 hours (average of 10 to 12 hours), and symptoms generally last 12 to 24 hours.

Clostridium perfringens is a bacterium found in soil and the gastrointestinal tract of healthy people and animals, including cattle, pigs, poultry and fish. The bacterial cells form spores that allow the organism to survive periods of environmental stress, such as temperature extremes and dryness. Illness occurs when food contaminated by soil or feces is held under conditions favorable for multiplication of the organism and is subsequently ingested. Once ingested, the organism

replicates in the gastrointestinal tract and produces an enterotoxin that causes the characteristic symptoms. The illness is not transmissible person-to-person.

Illness is usually associated with inadequately heated or reheated “dense” foods such as meats, stews, and gravies. Bacterial spores survive normal cooking temperatures, germinate and then multiply during slow cooling, storage at room temperature, and inadequate reheating. Statistical analysis revealed that the most likely meal associated with transmission was dinner on April 18, and the most likely contaminated meal item was chicken a la king. In addition, the sample of chicken a la king had a high APC, indicating possible mishandling or temperature abuse. Foods must be maintained at temperatures at or below 41°F or at or above 140°F at all times except during preparation. Cooked foods must be cooled from 140°F to 70°F within two hours and from 70°F to 41°F within an additional four hours. Since illness was confined to one ward of the jail, it is possible that temperature abuse (slow cooling or improper holding temperatures) may have occurred during meal distribution to inmates on individual wards. *Clostridium perfringens* was not detected in the chicken a la king, although it is not uncommon for pathogens to be unevenly distributed in food.

In general, most outbreaks of *C. perfringens* foodborne intoxication can be prevented by strictly adhering to the following food safety practices:

1. Monitor and maintain proper temperatures of heating, cooling, and holding equipment.
2. Monitor and maintain proper temperatures of food during storage and holding.
3. Cool foods rapidly to achieve proper temperature. Cooling can be accomplished by using one or more of the following methods:
 - Placing foods in shallow pans
 - Separating foods into smaller or thinner portions
 - Using rapid cooling equipment, such as ice baths or ice paddles
 - Using containers that facilitate heat transfer
 - Adding ice as an ingredient

References

¹Control of Communicable Diseases Manual. American Public Health Association, 17th edition, 2000.
James Chin, ed.

**Onset Times of Illness
County A Jail, 2002**

